USER INTERFACE DEVICES FOR MISSION CONTROL

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ABSTRACT

The Mission Control Center (MCC) at Johnson Space Center (JSC) in Houston, Texas is being upgraded with new technology engineering/scientific workstations. These workstations will replace the existing consoles and will emulate the present hardware input and display media. The workstations will be using new and different input devices for the flight controller to interact with the workstation and mainframes. This paper presents the results of the USER INTERFACE survey conducted by the Workstation Prototype Lab (WPL). The WPL offered the opportunity for users to do "hands-on" evaluation of a number of user interface options that Lab personnel had prototyped.

INTRODUCTION

The System Development Division's Workstation Prototype Lab (WPL) demonstrated several interactive computer input devices to space shuttle flight controllers. The input devices that were presented as possible candidates for the future Mission Control Center (MCC) included the following:

a) Touch Screen – Comprised of two sheets of plastic film placed over the terminal display whose inner sides are coated with a resistive substance.

When the screen is touched, an analog signal corresponding to that point is generated and sent to the associated controller box. The control box then converts the analog signal to a digital value which is used by the host workstation to determine which point on the screen was touched.

b) Mouse – Used to control the terminal screen's cursor

The optical mouse is moved over a special tablet to initiate movement. The mechanical mouse is similar to an "upside-down" track ball and is moved on a smooth surface to initiate cursor movement. Once the cursor has been moved to the desired screen position, a button or a series of button would be pressed to initiate a particular function.

c) Joystick – Used to control the terminal screen's cursor.

The cursor is moved in the same direction as the joystick lever. Once the cursor is placed on the desired screen position, a button or a series of buttons would be pressed to initiate a particular function.

d) Keyboard/Key Pad – Uses the standard keyboard and special keypads to manipulate a cursor position on a screen or to invoke a user selection.

This input device also includes all function keys, directional arrows, numeric keypads, etc.

e) Continuous Voice Recognition System – Accepts a speech input that is transmitted electronically to the voice recognition system via microphone.

The system takes the analog voice signal, digitizes the pattern, and stores this pattern in its memory. These sets of patterns can be stored on small floppy disks or on a host workstation. Then, each time a waveform is received be the system, it performs a pattern match to the digitized "vocabulary" previously stored in memory. If a good match is found the work is said to be "recognized" and its predefined function is send to the workstation to execute a command. The voice system also has the capability to playback recorded messages and response messages from the host computer.

USER INTERFACE SURVEY

To provide the benefit of hands-on experience, a program was created which guided the users through a series of demonstrations designed to show how these devices could be applied to practical problems facing future users of the next generation MCC software. This program provided the user with a means of calling up various displays and simulating the initiation of Orbiter commands.

Over 150 people participated in the original demonstrations and each was asked to make inputs to a relational database with their rating on each device as applied to a specific application. Since the original demo, another 400 people have seen the workstation input devices. In the table below, results from the original evaluation is shown (see Table I). Note that 9.0 is the highest possible rating and 1.0 is the lowest possible rating.

CONCLUSIONS

The results from these demonstrations shows that the Mouse and Keypad were the preferred input devices for the flight controllers. Additionally, there was a limited number of votes for the touch screen. It was determined the mouse was very good for grabbing and dragging an object on the screen. The mouse will be used for moving and resizing windows and for building displays with a graphics editor. The keypad software is application specific, but with compiler libraries provided by the workstation vendors, software with keypad input can easily be written. The touch screen input will be offered only as an option to the MCC upgrade program.

TABLE I

Command Demo	Device Type	Display Demo
7.7	Touch Screen	7.9
5.4	Mouse	5.7
3.0	Joystick	3.3
4.7	Keypad	7.0
*	Voice	5.5

* Voice Input was not applicable for the Command Demo